

CLAIMS:

What is claimed is:

1. A MRI RF receiver coil for imaging the breast, said receiver coil comprising;

two quadrature or 4-channel phased array RF receiver coils for MR imaging of both breasts,

a means for attaching compression plates, said compression plates being oriented either in the left/right or head/feet directions.

an opening in the top of the coils of sufficient size to accommodate the patient's breasts inside the RF coil assemblies,

an opening in the front of the coil, providing frontal access to the patient's breast for performing interventional procedures inside MRI scanners

an opening on the lateral side of the coil, providing lateral access to the patient's breast for performing interventional procedures inside MRI scanners

a patient support means including a beam between the bilateral breast coils, an abdominal support and a support for the head and shoulders

2. A coil according to claim 1, further comprising a support for the head and shoulders which is elevated to provide additional access to the breast.

3. A coil according to claim 1, further comprising a compression plate with a plurality of needle guide holes, said compression plate capable of compressing the breast either laterally or in the head/feet directions.

4. A coil according to claim 1, further comprising a compression plate with a plurality of access windows, said compression plate capable of compressing the breast either laterally or in the head/feet direction.

5. A compression plate according to claim 4, further comprising MR visible material embedded or attached to the housing of said compression plate.

6. A MR compatible mechanical device for positioning an interventional instrument such as a biopsy needle or therapy probe inside a MRI scanner, said positioning device comprising;

an instrument platform in which a biopsy or therapy instrument is secured to a mechanical positioning device, said platform being moveable to align the instrument trajectory, insert the instrument into the patient and remove the instrument from the patient..

a mounting block to control the vertical and horizontal motion of the instrument platform, said mounting block including or attached to a mechanical means for horizontal motion of the instrument platform and another mechanical means for vertical motion of the instrument platform.

a base-plate that is attached to a mechanical means that moves said base-plate in a horizontal or vertical direction,

a single post or a plurality of posts that support the aforementioned mounting block and physically link said mounting block to the aforementioned base-plate, said support post(s) attached to a mechanical means for moving said mounting block,

a plurality of mechanical means for adjusting the position of the aforementioned instrument platform , mounting block and base-plate,

7. The apparatus of claim 6, further comprising a means of mounting the positioning device to said imaging coil.

8. The apparatus of claim 6, whereby the positioning device is located in front of the coil, providing a means to insert instruments into the patient from the direction of the patient's head.

9. The apparatus of claim 6, whereby the positioning device is located on the side of the coil, providing a means to insert instruments into the patient from the lateral direction.

10. The apparatus of claim 6, further comprising a plurality of positioning devices that can be used to position a plurality of instruments in one or both breasts.

11. The apparatus of claim 6, further comprising an acme screw for moving the base-plate along a horizontal or vertical axis,

12. The apparatus of claim 6, further comprising an inchworm gear for moving the instrument platform along a horizontal or vertical axis,

13. The apparatus of claim 6, further comprising a rack and pinion mechanism for moving the instrument platform along a horizontal or vertical axis,

14. The apparatus of claim 6, further comprising a mechanical means of rotating the support post about an axis.

15. The apparatus of claim 14, further comprising a plurality of gears for rotating the support post about an axis.

16. The apparatus of claim 6, further comprising manually operated drive shafts and gears to adjust the position of the instrument platform inside the MRI scanner.

17. The apparatus of claim 6, further comprising cables to adjust the position of the instrument platform,

18. The apparatus of claim 6, further comprising an instrument platform with side rails for guiding an instrument along a predetermined trajectory.

19. The apparatus of claim 6, further comprising an instrument platform with indentations or clamps to secure the instrument into a locked position in the instrument platform.

20. The apparatus of claim 6, further comprising a needle guide for guiding the needle along a predetermined trajectory.

21. The apparatus of claim 6, further comprising a needle guide containing MR visible material for trajectory alignment of an instrument by means of MR imaging.

22. The apparatus of claim 21, further comprising a method for aligning the trajectory of an instrument and verifying the insertion trajectory of an instrument in a MRI scanner using real time MR imaging, said trajectory imaging method comprising;

selecting a desired trajectory to a lesion from a set of MR images,

acquiring a time series of real time MR images in the plane of the desired trajectory to the target,

adjusting the position of the MR visible needle guide until it appears in the images aligned with the desired trajectory to the target,

inserting the instrument into the patient along the trajectory indicated by said needle guide,

acquiring real time MR images in the plane of the instrument as it is inserted to verify that the trajectory conforms to the desired trajectory,

interactively adjusting the insertion trajectory of the instrument to maintain a correct course using real time MR images for feedback.

23. The apparatus of claim 21, further comprising a method for aligning the trajectory of an instrument and verifying the insertion trajectory of an instrument in a MRI scanner using real time MR imaging, said trajectory imaging method comprising;

selecting a desired trajectory to a lesion from a set of MR images,

acquiring a series of real time MR images perpendicular to the plane of the desired trajectory, said imaging plane centered on the desired trajectory to the target and offset to include a cross-section of the MR visible needle guide,

adjusting the position of the MR visible needle guide until the cross sectional image of the needle guide indicates that said needle guide is aligned with the desired trajectory to the target,

inserting the instrument into the patient along the trajectory indicated by said needle guide,

acquiring real time MR images in the plane of the instrument as it is inserted into the patient to verify that the trajectory conforms to the desired trajectory,

interactively adjusting the insertion trajectory of the instrument to maintain a correct course using real time MR images for feedback.

24. The apparatus of claim 21, further comprising a means to manually insert the instrument along the trajectory indicated by said needle guide,

25. The apparatus of claim 6, further comprising an instrument platform for positioning therapy instruments, such as RF, laser, cryogenic or drug delivery probes, inside a patient in a MRI system using real time imaging for guidance and monitoring of the therapy.

26. The apparatus of claim 6, further comprising a remotely controlled means for adjusting the position of the instrument inside the MRI scanner.

27. The apparatus of claim 6, further comprising an electronically controlled means for adjusting the position of the instrument inside the MRI scanner.

28. The apparatus of claim 27, further comprising a robotically controlled means for adjusting the position of the instrument inside the MRI scanner.